ISEL
ADEM
Área Departamental de Engenharia Mecânica

Curricular Unit Form (FUC)

Course:	**FIRST CYCLE IN MECHANICAL ENGINEERING**					
Curricular Unit (UC)	**Mechanics of Materials II**			Mandatory	**X**	
				Optional		
Scientific Area:	**Mechanical Project, Manufacturing and Industrial Maintenance**					
Year: **2**	Semester: 2	ECTS: 5,5		Total Hours: **4,5**		
Contact Hours:	T:	TP: 67,5	PL:	S:	OT:	TT: 67,5
Professor in charge		Academic Degree /Title		Position		
Maria Amélia Ramos Loja		**PhD**		**Assistant Professor**		

T- Theoretical ; TP – Theory and practice ; PL – Laboratory ; S – Seminar ; OT –Tutorial ; TT – Total of contact hours

Entry into Force	Semester: **Winter**	Academic Year: **2016/2017**

Objectives of the curricular unit and competences (max. 1000 characters)

Extended the fundamental concepts of the theory of elasticity in linear elastic regime and put on an analysis of the mechanical behavior of structural and mechanical components. It will use the approach of structures through energy methods and made the deepening of the concepts associated with bending and twisting of complex components.

Still constitute objectives of the curricular unit understanding of fundamental concepts used in the context of the project and computer aided design of structures. It will introduce the fundamental concepts of the theory of rectangular plates and the application of symbolic computation in complex real cases.

Syllabus (max. 1000 characters)

General stress and strain relations and energy methods: General stress and strain relations; Equilibrium and compatibility equations; Strain elastic energy; Energy principles; Principle of virtual work; The principle of minimum potential energy; Castigliano´s theorems; Displacements in statically indeterminate structures beams and frames.

Bending and torsion of non-symmetric beams: Curved beams; Combined bending; Bending of unicellular and multicellular tubular beams; Torsion in thin-walled open section, closed single profiles and multicell profiles; Shear stresses and shear flow; Shear center of a channel section.

Combined Loading: General states of stresses; Equivalent stresses; Combining loads that generate uniaxial and multiaxial state of stress.

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Elements of the theory of rectangular plates: Kirchoff theory's assumptions; Constitutive laws for isotropic plates; Rectangular plates; Navier method and Rayleigh-Ritz method; Applications using symbolic computation.

Demonstration of the syllabus coherence with curricular unit's objectives (max. 1000 characters)
The fundamental concepts of the syllabus are introduced in class, based on real structural or mechanics systems, allowing students perceive either the qualitative and quantitative aspects. The sequence of the syllabus leads the student to understand the static behavior of components of structures and mechanical systems. Understanding the interaction of multiple components and the perception of the importance of the equilibrium equations and energy methods in the analysis of structures and mechanical systems, represent methodologies essential to the achievement of the fundamental objectives of the course (UC). In the final part of UC are presented videos and computational animations that enable a better understanding of the essential aspects of the study of stresses and deformations in structures. It is made a first contact with the finite element methods and is further recourse of symbolic computation, which enables the analysis of complex structures.

Teaching methodologies (including evaluation) (max. 1000 characters)
The teaching is done through theoretical-practical classes. The classes will work with brief presentations on each topic, practical examples where the student intends to consolidate the concepts studied, followed by solving exercises where students apply the knowledge acquired. Some of these classes will involve carrying out work using commercial computer programs. The assessment is carried out through continuous assessment or final exam assessment. Continuous assessment evaluation will be performed by computational assignments (NTC) as well as a written evaluation (NE). The final grade (NF) on the Curricular unit is the result of: NF = 0.60 x NE + 0.40 x NTC The final exam assessment includes a written test.

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Demonstration of the teaching methodologies coherence with the curricular unit's objectives (max. 3000 characters)
In teaching methodologies are used different methods that enable the objectives of the course. Considering the characteristics of the concepts to teach, theoretical-practical classes are used, which enable students to understand and apply the fundamental concepts associated with course program. In theoretical-practical classes are used the potential of new multimedia systems and made the use of computer programs, namely symbolic computation, for simulation analysis models of the static behavior of structures and mechanical systems, considered as deformable bodies. It is made the generalization of the linear elastic analysis to symmetrical and unsymmetrical components of structural systems and for rectangular plates, with different boundary conditions.

Main Bibliography (max. 1000 characters)
Mechanics of Elastic Structures (2nd edition) , Oden, J.T. and Ripperger, E.A., McGraw-Hill. Mechanics of Materials, Ansel C. Ugural, Wiley. Theories and Applications of Plate Analysis: Classical Numerical and Engineering Methods, Rudolph Szilard, Wiley. Mechanics of Materials Volume 1, Third Edition: An Introduction to the Mechanics of Elastic and Plastic Deformation of Solids and Structural Materials (v. 1), 3rd Edition, Hearn, E.J., Butterworth-Heineman. Mechanics of Materials 2, Third Edition: The Mechanics of Elastic and Plastic Deformation of Solids and Structural Materials), 3rd Edition, Hearn, E.J., Butterworth-Heineman. Engineering Mechanics of Solids (2nd Edition), Egor P. Popov, Prentice Hall. Mechanics of Materials (6 Edition), Ferdinand Beer, Jr., E. Russell Johnston), John DeWolf, David Mazurek, McGraw-Hill.